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Nuclear Reactor Simulator

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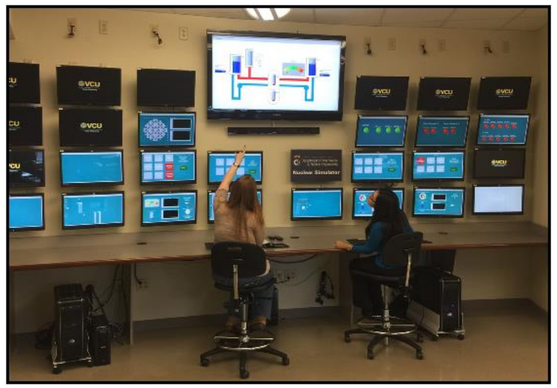
MECHANICAL AND NUCLEAR

Nuclear Reactor Simulator

Senior Design Team 2014-2015

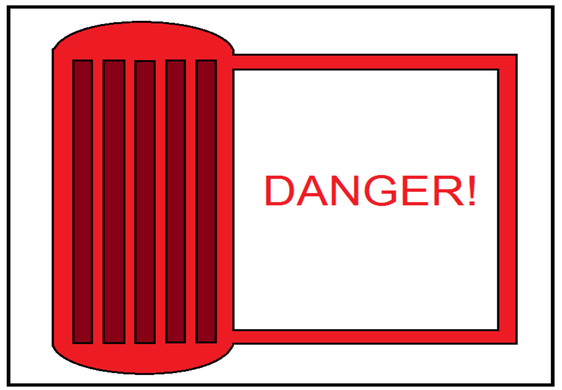
CAPSTONE DESIGN EXPO 2015

Student-to-Model Interaction



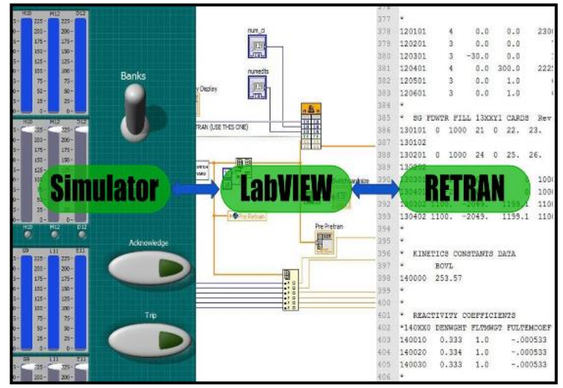
On start-up, operators monitor the behavior of the simulator as it approaches null transient, steady-state operation.

Accidents Introduced



The instructor introduces a transient which forces the operators to respond by manipulating the controls of the simulator interface.

Real-Time Model Changes



The model receives Input from the operators and passes it through LabVIEW to RETRAN-3D where plant conditions are updated. New data is looped back to the users, allowing them to interact in real-time.

Simulator Overview

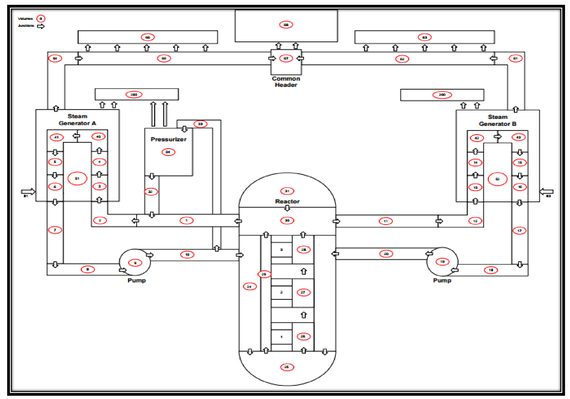
The purpose of the simulator is to accurately predict conditions within a nuclear power plant. To do this, the simulator employs a professional thermal hydraulics computer code, RETRAN-3D, to generate best-estimate predications of the reactor and surrounding systems. The results of the RETRAN-3D calculations are sent to the instructor, primary, and secondary workstations where the results are displayed and controlled by LabVIEW, a graphical programming language. The simulator runs in real time with information passed between LabVIEW and RETRAN-3D every tenth of a second.

2014-2015 Enhancements

Additional enhancements added by this year's team:

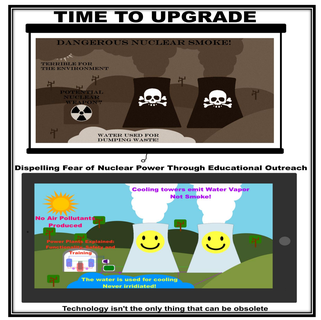
- Addition of control rods and reactivity
- Better instructor capabilities (manual trip controls)
- Improved overall model robustness and stability
- Implementation of automated reactor trip logic
- Upgraded computers with solid-state hard drives
- Integration of key secondary side plant systems:
  1. Main and Auxiliary Feedwater Systems
  2. Safety Injection System
  3. Turbine Electro-hydraulic Control System

RETRAN-3D Model



Simulator Applications

- Simulator demonstrations and educational sessions held for Girl and Boy Scouts and visiting school groups
- Utilized as an instructional education tool for use in nuclear engineering courses
- Demonstrations for industry experts and advisors



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